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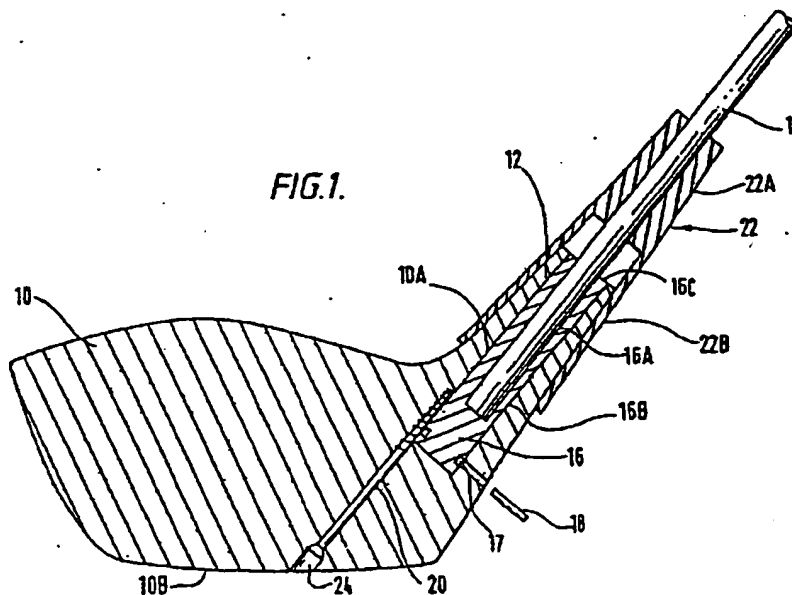
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(54) Golf club heads

(57) A golf club is assembled from a club head (10) and a shaft assembly (14,16) including a shaft (14) and a tubular bush (16) having a bore which is inclined with respect to the axis of its outer surface. The bush 16 may be fitted into a bore (10A) in the club head (10) in a number of alternative rotational positions so that the lie and face angle of the head (10) can be varied without exchanging club heads, thereby allowing a retail outlet to provide a wide choice of club characteristics without having to keep a large stock. Means are provided for calibrating the rotational position of the bush (16) in the head (10) to achieve a required face angle and lie combination whereupon the shaft assembly (14,16) is bonded in the head (10), with a pin (18) engaging the shaft assembly (14,16) and passing through the head for additional anchorage.



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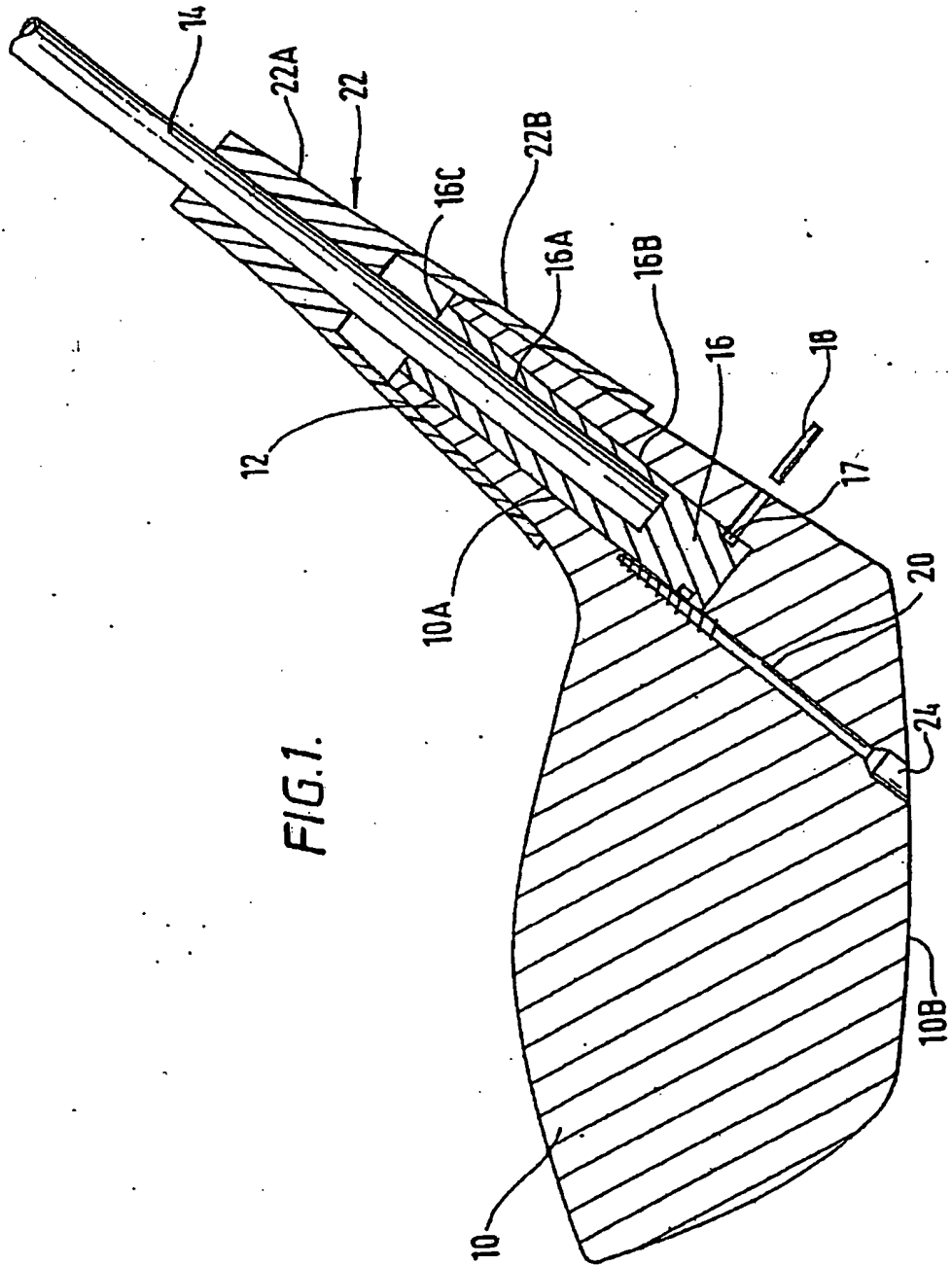


FIG. 1.

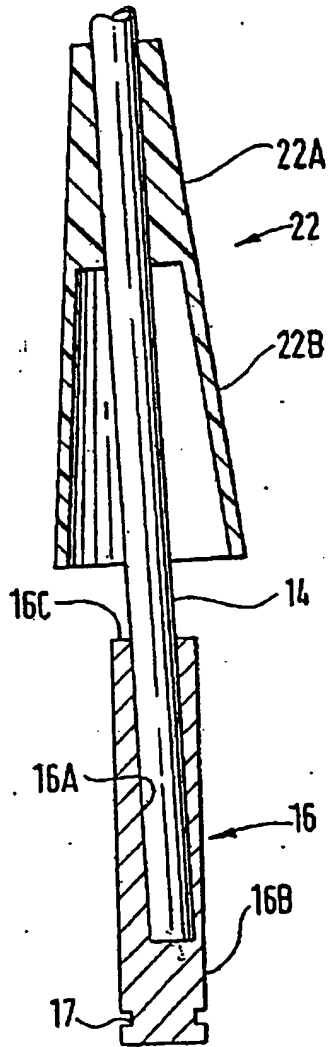


FIG. 2.

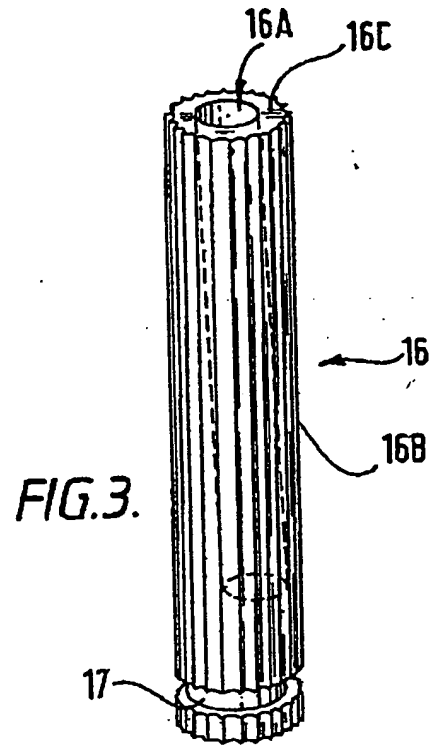


FIG. 3.

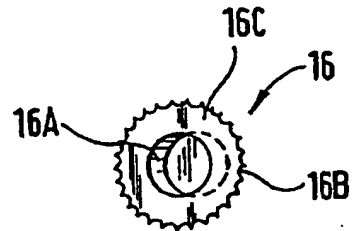


FIG. 4.

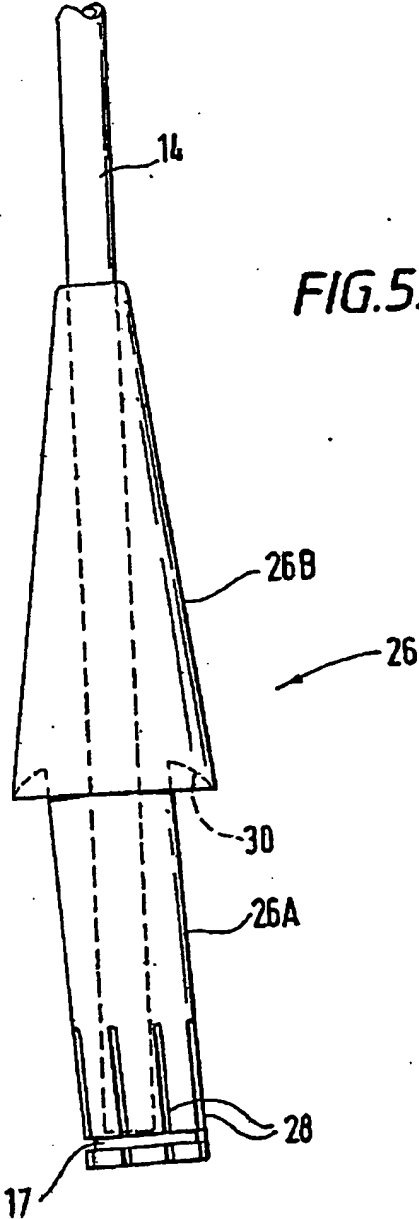


FIG. 5.

## SPECIFICATION

## A golf club

5 This invention relates to a golf club which has a shaft assembly connected to a head, the relative orientation of the head and the shaft assembly being chosen to give a desired trajectory characteristic for a given swing path and an individual player's characteristics.

10 It is known to construct a golf club from a shaft, usually made from steel, which is glued and optionally pinned into the neck of a club head. To provide a secure fixture and to prevent splitting, the neck is reinforced with whipping on plastics, or other sleeving. The weight and shape of the club head, and the angle of the shaft with respect to the club head amongst other features, determine the playing characteristics of the club. Relatively few clubs are "custom" made to suit individual players, most being instead mass-produced with standard dimensions and angles, allowing only a limited variety of clubs to be produced and making it difficult for the individual to select a club to suit his or her precise needs. This also makes it necessary for a retail outlet to store a large and expensive range of clubs to provide customers with a reasonable choice in performance and style of club.

30 It is an object of the present invention to provide a club tailored to the needs of an individual player without requiring retail outlets to stock a large variety of clubs having different characteristics.

35 According to a first aspect of this invention, a golf club comprises a club head and a shaft assembly, the shaft assembly including a golf club comprising a club head and a shaft assembly, the shaft assembly including a major portion defining a first longitudinal axis and a lower end portion defining a second longitudinal axis, and having the lower end portion mounted to the club head such that the orientation of the club head with respect to the first longitudinal axis is defined by the position of the lower end portion with respect to the club head and the inclination of the second longitudinal axis with respect to the first longitudinal axis. The lower end portion of the shaft assembly may include a generally cylindrical bush having an inclined bore for receiving a lower end of a shaft, the shaft defining the first longitudinal axis and the outer surface of the bush defining the second longitudinal axis. In the preferred embodiment of the invention, such a bush is received in a bore in the club head, the rotational position of the bush in the head determining the orientation of the head with respect to the first longitudinal axis. Means, such as longitudinal surface discontinuities, may be provided on the outer surface of the bush to allow location of the bush at a required rotational position, the  
65 longitudinal discontinuities engaging with one

or more surface discontinuities in the bore in the club head.

70 The lower end portion or bush may be a stub shaft and the axis thereof is preferably inclined with respect to the axis of the shaft assembly by an angle less than or equal to 6°, and usually less than or equal to 4°.

80 In the preferred embodiment of the invention, the shaft assembly comprises a tubular metal or synthetic shaft having a grip at one end, and the bush is secured to the shaft at or adjacent, the other end of the shaft, the bush having a generally cylindrical outer surface defining the second longitudinal axis. The bush may be a plastics component moulded in situ on the shaft, or it may be a metal component bonded to the shaft. In either case it is preferably a sleeve, having a blind bore for receiving the shaft, and having a recess to receive a pin for providing additional securing means between the shaft assembly and the club head. Since the outer surface defines an axis which is inclined with respect to the axis of the bore in the bush, and since the bush may be received in the bore in the head in a number of different rotational positions a single shaft assembly allows selection of a number of different possible orientations of the head with respect to the first longitudinal axis. By selecting the angle of inclination of the two axes with respect to each other and by selecting the rotational position of the lower end portion of the shaft assembly in the head, the lie of the club can be selected from a wide variety of positions between "upright" and "flat", and, similarly, the face of the club can be selected to be "open" or "closed" to a required degree. In the preferred embodiment of the invention, the lower end portion may be fitted into the head in a number of different rotational "rest" portions until the desired characteristics are obtained, and then the finally selected position can be fixed by bonding the lower end portion to the head. In this way, the customer can be provided with a club to suit his or her particular requirements at a substantially lower cost compared with a conventional "tailor-made" club. The club may be constructed from a comparatively limited stock of parts at a place where limited skills and facilities are available, such as a retail outlet.

120 According to another aspect of the invention, a method of assembling a golf club comprises providing a golf club head, providing a golf club shaft assembly having a major portion defining a first longitudinal axis and a lower end portion defining a second longitudinal axis inclined with respect to the first longitudinal axis; mounting the lower end portion of the shaft assembly to the head at a required rotational position whereby the head has a required orientation with respect to the first longitudinal axis.

130 In the case of the shaft assembly compris-

ing a shaft and a bush, with the head having a bore for receive the bush, the method includes the steps of inserting the bush in the head and inserting the shaft into the inclined or offset bore in the bush. The position of the bush in the head as well as the relative inclination of the two longitudinal axes determines the orientation of the head with respect to the first longitudinal axis. Preferably, the method includes applying an adhesive to at least one of the interengaging surfaces of the shaft assembly and the head prior to the mounting step thereby to fix the bush to the head in the required rotational position.

The invention will be described below by way of example with reference to the drawings in which:

Figure 1 is a cross-section through part of a golf club in accordance with the invention;

Figure 2 is a partly cross-sectioned view of part of the shaft assembly of the club of Figure 1;

Figure 3 is a perspective view of a bush forming part of the shaft assembly of Figure 2;

Figure 4 is a top view of the bush; and  
Figure 5 is a side elevation of part of an alternative shaft assembly.

Referring to Figure 1 of the drawings, a golf club in accordance with the invention comprises a club head 10 having a neck portion 12 which is drilled to receive the lower end portion of a shaft assembly including a shaft 14 and a bush 16. The shaft 14 forms a major portion of the shaft assembly and has at its upper end a grip (not shown). In this embodiment of the invention the shaft 14 is a straight metal tube defining a first longitudinal axis of the shaft assembly. In accordance with the invention, the bush 16 is shaped such the lower end portion of the assembly defines a second longitudinal axis of the shaft assembly. In accordance with the invention, the bush 16 is shaped such the lower end portion of the assembly defines a second longitudinal axis by virtue of having a blind bore 16A for receiving the lower end of the shaft 14 and a substantially cylindrical outer surface 16B defining an axis inclined with respect to the bore 16A. When the bush 16 is fitted in a drilled bore 10A in the head 10, the axis of the shaft 14 is at an angle to the axis of the bore 10A in the head, the axes intersecting at a distance of less than or equal to about 125mm above the sole 10B of the head (along the axis of the shaft). It will be appreciated that the orientation of the head 10 with respect to the axis of the shaft 14 depends on the rotational position of the lower portion of the shaft assembly in the bore 10A. Thus, with a given shaft assembly having a predetermined angle between the first and second axes (referred to hereinafter as the "offset"), the club can be assembled to have a predetermined lie and face angle.

Typically, a retailer would be provided with a range of shaft assemblies having, on the one hand, different lengths, stiffnesses, flex-points and grips, and on the other hand, bushes with different offsets, e.g. 4°, 2° and 1°. The customer may then select a shaft assembly to suit his particular requirements, and match it with a club head selected from a range of different heads having a variety of characteristics (e.g. different lofts and weights), and, having a bore 10A at a selected angle for receiving the selected shaft assembly. If, for example, a shaft assembly with an offset of 2° is selected, and the bore in the head is at the "standard" shaft orientation specified by the golfing authorities, the face angle and the lie can be varied by a maximum of + or - 2° from standard, i.e. the face angle maybe at any angle between 2° open and 2° closed, and the lie can be selected to be at one of a range of values between 2° upright and 2° flat, according to the rotational position of the bush 16 when it is fitted into the bore 10A.

Alternatively, the bore 10A may be such that the mean lie or face angle deviates from the standard. For instance, a mean upright lie of 2° may be built into the head 10 in this manner. If, now, a shaft assembly with a 2° offset is mated with the head, the lie can be varied between 0° to 4° upright by appropriate selection of the rotational position of the head on the shaft assembly.

Turning now to the constructional details of the preferred embodiment, the bush 16 is a machined aluminium alloy component having, as shown in Figures 2, 3 and 4, a blind bore 16A drilled at an angle (the "offset") to its generally cylindrical outer surface 16B. The bore 16A may be provided with splines or other longitudinal discontinuities (not shown) to assist in anchoring the bush 16 to the shaft 14, or the bush may have a grub screw bearing transversely on the shaft. These are just two methods of fixing the bush to the shaft, in addition to use of an adhesive. The outer surface 16B of the bush 16 has surface discontinuities in the form of fluting or splines as shown in Figure 3 and 4 to assist in the location of the bush in the bore 10A in the head by engagement with a surface discontinuity in the bore 10A, in this case a screw 20 (shown in Figure 1) housed parallel to the axis of the bore 10A with its thread just protruding into the bore. Also the outer surface 16B of the bush 16 contains a recess 17, approximately 3mm deep and 3mm wide, cut into the lower part of the bush 16 about 3mm from the end of the bush. Following selection of a shaft assembly and head, and the required rotational position, the splined surface of the bush 16 is coated with a releasable adhesive and the assembly is slid into the bore 10A at the selected rotational position. The splines can be used as calibration marks

for location in the required rotational position. The screw 20 is inserted to engage one of the splines and then tightened to apply a longitudinal anchoring force to the shaft assembly. This provides additional resistance to tension and torsional forces. Further securing means against forces in the longitudinal axis are provided by inserting a plain metal pin 18 through a hole, which passes through the club head 10 into the bore 10A, and into the recess 17 in the lower part of the bush, which is filled with adhesive.

Prior to application of the adhesive to fix the bush 16 in the bore 10A, the orientation of the head 10 on the shaft assembly may be changed a number of times to allow trial of different lies and face angles, and indeed, to allow the customer to try different combinations of head and shaft assembly. Once the adhesive has been used, however, the position of the head is set, and can only be changed by the use of specialist/manufacturing facilities, and the use of special tools to remove the neckpin.

The dimensions of the bush 16 and the bore 10A are such that, when the bush is pushed fully home, the top surface 16C of the bush is flush with the end of the neck portion 12. To cover the joint between the bush and the head, a hosel 22 (Figures 1 and 2), having a collar portion 22A and a sheath portion 22B, is slid down the shaft 14 to cover the neck portion 12 as shown in Figure 1. This hosel is preferably made from a flexible hydrocarbon polymer such as ABS or urethane.

Since the bush 16 is completely contained in the neck portion 12 of the head 10, the external appearance of the preferred embodiment does not reveal the existence or nature of the inclination of the head on the shaft assembly, and with the hosel 22 in position the finished club has a similar appearance to the conventional club, there being a natural transition between the hosel 22 and the outer surface of the head 10. The head of the screw 20 is covered by a plug 24 inserted and bonded into the screw hole in the sole of the head.

An alternative shaft assembly is shown in part in Figure 5. This assembly has a combined bush and hosel component 26 which may be constructed from plastics material. Preferably, the component 26 is moulded in situ on the shaft 14, key means on the shaft 14 providing increased torsional strength. As before, the bush part 26A of the component has a cylindrical outer surface defining an axis inclined with respect to the axis of the shaft 14 to yield the required offset. In this case the bush part 26A has eight longitudinal grooves 28 for location with respect to the screw 20 (Figure 1), however the bush still contains the recess 17 to receive the pin 18. The hosel part 26B forms a continuation of the neck portion 12 of the head 10 (Figure 1)

to continue the taper of the neck portion 12 down virtually to the diameter of the shaft 14. Preferably the neck portion 12 has a hemispherical end which is received by a correspondingly shaped concave surface 30 of the hosel part 26B, to allow close abutment of the hosel part with the neck portion regardless of the rotational position of the bush 26A in the head 10.

A further alternative shaft assembly, not shown in the drawings, comprises a shaft having a lower end portion which is bent to the required offset angle, the bend being located so as to be immediately above the end of the neck portion of the head when the club is assembled.

The screw 20 shown in Figure 1 may be replaced by a bolt threaded coaxially from beneath into the lower end of the bush 16 and/or the shaft 14, the head of the bolt being recessed into the sole of the club head. A serrated lock washer may be placed beneath the bolt head. This fixing technique is particularly appropriate for metal or plastics "woods".

#### CLAIMS

1. A golf club comprising a club head and a shaft assembly, the shaft assembly including a major portion defining a first longitudinal axis and a lower end portion defining a second longitudinal axis, and having the lower end portion mounted to the club head such that the orientation of the club head with respect to the first longitudinal axis is defined by the position of the lower end portion with respect to the club head and the inclination of the second longitudinal axis with respect to the first longitudinal axis.

2. A golf club according to claim 1, wherein the shaft assembly comprises a shaft defining the first longitudinal axis and a bush having a bore receiving the lower end of the shaft, and wherein the bush is received in a bore in the club head, the outer surface of the bush defining the second longitudinal axis.

3. A golf club according to claim 2, wherein the outer surface of the bush includes means for locating the bush in the head at a required rotational position.

4. A golf club according to claim 3, wherein the bush has a plurality of longitudinally extending surface discontinuities for locating the bush at a required rotational position with respect to the head by engagement with at least one corresponding surface discontinuity in the head.

5. A golf club according to claim 1, wherein the orientation of the club head with respect to the first longitudinal axis is dependent on the rotational position of the shaft assembly with respect to the head.

6. A golf club according to any preceding claim, wherein the second longitudinal axis is inclined with respect to the first longitudinal

axis by an angle of less than or equal to 6°.

7. A golf club according to claim 2, wherein the bush is less than or equal to 4°.

8. A golf club according to claim 2, wherein the bush comprises a sleeve having a longitudinal bore receiving the end part of the shaft and a generally cylindrical outer surface engaging the bore in the head, the cylindrical outer surface of the sleeve defining the second longitudinal axis.

9. A golf club according to claim 2, wherein the bush is metallic.

10. A golf club according to claim 9, wherein the bush is secured to the shaft by an adhesive.

11. A golf club according to claim 1, further comprising a securing screw housed in the head and engaging the lower end portion of the shaft assembly.

12. A golf club according to claim 11, wherein the axis of the securing screw is substantially parallel to the second longitudinal axis.

13. A golf club according to any preceding claim, wherein the said first and second longitudinal axes intersect at a point less than about 125mm from the sole of the head.

14. A golf club comprising a club head and a shaft assembly, the shaft assembly including a major portion defining a first longitudinal axis and a lower end portion defining a second longitudinal axis, and having the lower end portion mounted to the club head such that the orientation of the club head with respect to the first longitudinal axis is adjustable by altering the rotational position of the lower end portion with respect to the club head about the second longitudinal axis.

15. A golf club comprising:  
a club head with an internal bore;  
a bush secured in the bore in the head and itself having an internal bore;  
a club shaft having an end portion secured in the bore in the bush;  
the bore in the bush being formed such that it defines a first axis which is inclined with respect to a second axis defined by the bore in the head.

16. A golf club according to claim 15, wherein the interengaging surfaces of the bush and the bore in the head have means for locating the bush in the head at a required rotational position about the second axis.

17. A method of assembling a golf club including:  
providing a golf club head;  
providing a golf club shaft assembly having a major portion defining a first longitudinal axis and a lower end portion defining a second longitudinal axis inclined with respect to the first longitudinal axis;  
mounting the lower end portion of the shaft assembly to the head at a required rotational position whereby the head has a required orientation with respect to the first longitudinal

axis.

18. A method according to claim 17, wherein the club head has a bore for receiving the lower end portion of the shaft assembly, and wherein the mounting step includes inserting the lower end portion into the bore.

19. A method according to claim 17, wherein the shaft assembly comprises a shaft defining the first longitudinal axis and a bush having an outer surface defining the second longitudinal axis, the bush having a bore inclined with respect to the second longitudinal axis for receiving an end portion of the shaft, and wherein the mounting step comprises inserting the bush into the bore at the required rotational position.

20. A method according to claim 19, including the step of securing the bush to the shaft to form the shaft assembly.

21. A method according to claim 19, including selecting a bush from a range of bushes defining different angles of inclination of the second longitudinal axis with respect to the first longitudinal axis.

22. A method according to claim 18, wherein the lower end portion of the shaft assembly and the bore in the head each have at least one surface discontinuity for locating the lower end portion in the head at the required rotational position, and wherein the insertion step includes orienting the lower end portion so that the said surface discontinuities engage with each other.

23. A method according to claim 22, wherein the lower end portion of the shaft assembly has a plurality of longitudinally extending surface discontinuities, the insertion step including selecting one or more of the said discontinuities for engagement with the surface discontinuity or discontinuities of the bore in the club head in order to select one of a plurality of possible rotational positions.

24. A method according to claim 18, wherein the head has a bore for receiving the lower end portion of the shaft assembly, and wherein an adhesive is applied to at least one of the interengaging surfaces of the bore and the lower end portion prior to the mounting step, thereby to fix the lower end portion in the bore once the required orientation of the shaft with respect to the head has been obtained.

25. A method according to claim 18, including tightening a screw housed in the head with its axis substantially parallel to the second longitudinal axis, the screw having a threaded portion engaging the lower end portion of the shaft assembly to secure the assembly in the bore.

26. A method of assembling a golf club comprising:  
providing a golf club head;  
providing a golf club shaft having a first longitudinal axis;  
providing a bush having a second longitudinal



- nal axis for mounting the head to the shaft, the bush being selected to provide a required angle between the first and second longitudinal axes;
- 5 mounting the bush to the golf club head at a required rotational position;  
mounting the shaft to the bush;  
whereby the head has a required orientation with respect to the shaft.
- 10 27. A method according to claim 26, wherein the bush is fitted to one end of the shaft to form a shaft assembly having a lower end portion with a longitudinal axis inclined with respect to the first longitudinal axis.
- 15 28. A method according to claim 26, wherein the bush has means on its outer surface for locating the bush in the club head at a particular rotational position.
- 20 29. A golf club constructed and arranged substantially as herein described and shown in the drawings.
30. A method of assembling a golf club, the method being substantially as herein described with reference to the drawings.

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